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# **Radium Isotopic Analyses in the Shelf-Basin Interaction (SBI) Program and Investigation of the Rate of Shelf-Basin Interaction in the Western Arctic**

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## **LONG-TERM GOALS**

To utilize the distribution of radioisotopes in the ocean for the purpose of unraveling oceanic circulation patterns and investigating the rates of mixing processes. Specific problems of current interest include shelf-basin exchange in the western Arctic (including eddy processes) and ocean ventilation and subduction processes. Because these isotopes have half-lives ranging from days to years, it is possible to study processes that encompass a great variety of temporal and spatial scales.

## **OBJECTIVES**

The objective of this work is to characterize the shelf-basin transport within the western Arctic Ocean. Data generated here will augment studies funded under the NSF SBI program.

## **APPROACH**

We are utilizing the naturally occurring radioactive isotopes  $^{226}\text{Ra}$ ,  $^{228}\text{Ra}$ ,  $^{224}\text{Ra}$  and  $^{228}\text{Th}$  to characterize the pathways and rate of transport between the shelf and deep basin of the western Arctic. This project is being performed in concert with the multi-institutional SBI project funded by the NSF.

## **WORK COMPLETED**

We have analyzed all 46 samples collected during the SCICEX project from the year 2000. The isotopes analyzed were  $^{228}\text{Ra}$  and  $^{226}\text{Ra}$ . In addition, we have prepared and shipped material to J. Gossett for future sampling should that occur within the SBI region of interest. We are awaiting word as to the status of that possibility. In addition, we have purchased and constructed an instrument for analyzing the short-lived isotopes  $^{223}\text{Ra}$ ,  $^{228}\text{Th}$  and  $^{224}\text{Ra}$ . This was successfully used in the SBI 2002 field season where over 200 samples were collected and analyzed.

## **RESULTS**

The most significant result in the 2002 sampling season was the discovery of near shore eddies off the Alaska coast. This was demonstrated by distinct tracer and temperature distributions obtained by closely spaced CTD and XCTD profiles. This likely will prove to be a significant consideration in

determining the mechanism of cross-shelf transport in this region as has been postulated by others. The tracer distributions offer a way of proving, and quantifying these earlier hypotheses.

### **IMPACT/APPLICATIONS**

The discovery of coastal eddies in the N. Alaska coastal zone signifies a potentially important mechanism for shelf-basin exchange in the western Arctic.

### **TRANSITIONS**

These results will eventually be used by other chemists and biologists to refine their estimates of mass transport between the shelf and deep Arctic basin. In addition, physical oceanographers will have a tracer of eddy formation and transport processes.

### **RELATED PROJECTS**

This project is being performed in conjunction with the Shelf-Basin Interaction (SBI) program under the ARCCS program of the NSF (<http://utk-biogw.bio.utk.edu/SBI.nsf>). Over 200 samples were collected under this program in 2002 and analyzed with equipment funded by the ONR High Latitude Program. This project will continue through 2005.